# Recent World Bank publications on disaster risk finance

Two papers are presented here from The Policy Research Working Papers series, prepared in the framework of the Disaster Risk Financing and Insurance Program (DRFIP) of the World Bank Group - Finance and Markets Global Practice Group and published in June 2016. The aim of this working group is to encourage an exchange of ideas on economic development issues.

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## The Policy Research Working Paper 7720

Solving commitment problems in disaster risk finance

#### D.J. Clarke and L. Wren-Lewis

The initial premise of this paper is that, in the event of a natural catastrophe, the population does not receive the aid it needs. Three causes have been indentified: the first is that households tend to be under-protected in the face of natural disasters –either when taking out insurance or when putting material resources into place for mitigating the consequences– because they are confident that, if a catastrophe occurs, they will receive assistance from



governments and private institutions (the Samaritan dilemma). Moreover, the reality of such situations shows that, often, the support arrives late and, due to political corruption and illegitimate interests of the private institutions donating the aid, the relief is misallocated and not distributed in proportion to the damage suffered, reaching the point where some people receive assistance who have not undergone any loss at all.

It is assumed that these problems do not arise –or do so to a lesser degree– in developed countries where the "reputation" of the donors –governments or private institutions– precludes failure to fulfil promises and where there is a separation of powers making it technically impossible to avoid meeting commitments.

According to the authors, the root of the three problems lies in the incapacity of the donors to put their prior commitments into practice, and they propose transferring the risk to third parties as the solution, either through insurance or by using risk transfer financial instruments, such as catastrophe bonds or swaps. The paper also makes a detailed analysis of how and when each kind of instrument should be used in order to prevent over-selling, as if it were a miracle cure against disasters.

The authors support themselves on a model based on the behaviour of *recipients* (those affected by the catastrophe) and *benefactors* (the donors of the relief) in order to demonstrate the following propositions:

**Proposition 1.** When people perceive that, in the event of a catastrophe, they will receive aid from an institution, the recipient will not invest in self-protection, even when it would be clearly beneficial to do so. This will lead to insufficient relief, except in those cases where the benefactor is absolutely altruistic.

**Proposition 2.** Benefactors are more willing to invest money in preventing the inadequate allocation of aid before a disaster strikes, for example, by establishing rigorous auditing mechanisms capable of preventing corruption at any point in the chain of distribution of the relief.

For this reason, it is more effective if donors commit to providing aid prior to a catastrophe than after it has occurred.

Proposition 3. Benefactors take longer in disbursing aid if the number of donors is sufficiently large.

One way of avoiding this tendency would be for each benefactor to unilaterally commit to providing the relief as soon as possible, regardless of what the rest may do.

The final conclusion reached is that a natural disaster relief system based on the generosity of individuals or institutions is inefficient in practice.

The authors of the paper have examined a number of measures that relief donors could adopt to improve the efficiency of the system:

**1. Transfer the risk to third parties,** either by subsidising the insuring of the recipient or by taking out insurance themselves instead of handing over post-disaster cash.

Making insurance by the recipient compulsory –the laws of some countries establish this obligation– is an incentive for recipients to take measures for mitigating losses (thereby preventing the Samaritan dilemma), since the insurance premium is established in relation to the risk. In addition, the insuring of the benefactor eliminates the possible increase in the marginal cost of seeking post-disaster financing.

Moreover, involving the insurance sector would help to solve the problem of corruption in the allocation of the relief, because the sector would be the first to be concerned with ensuring that the compensation paid is received solely by those who have suffered losses. Likewise, this would drive donors to provide truthful information on the losses.

Finally, the payments would arrive on schedule without delays due to the re-negotiation of the aid by donors after the loss has occurred.

**2. Integrate the information systems on the payments made.** Adopting common systems could prevent the lack of commitment on the part of some donors to collect or disclose accurate information on losses from rendering the relief system inefficient. Once again, the insurance companies would be the first to have an interest in seeing the system operate effectively, in order to maintain the confidence of their insured.

**3. Use "disaster indices",** which are basically statistics built on the basis of objective data (for example, data supplied by weather satellites or seismic stations), correlating them with the loss data. This eliminates, in part, the problem of the misallocation of the relief due to the corruption of intermediaries, since an index is less vulnerable to manipulation than mere data on losses, as it is supported on a technology which is more difficult to falsify.

## The Policy Research Working Paper 7721

Evaluating sovereign disaster risk finance strategies. A framework

#### D. Clarke, O. Mahul, R. Poulter and T.L. Teh

This paper analyses the financial instruments available to governments for meeting the costs of the losses caused by climatic catastrophes on a national scale. The aim of the study is to facilitate the choice between one financing strategy and another depending on the real risk of disaster, economic conditions and political constraints of the hypothetically affected country, in such a way as to reduce the cost for the national budget as far as possible.

In addition, it develops a quantitative method for determining a strategy that will minimise the average cost or minimise the cost of disasters above a given return period (of a particular magnitude).

To do so, the authors use a quantitative method built in two stages, where the government can choose one or several strategies for financing possible losses (x) up to a maximum amount (X). The strategies examined are:

- risk transfer instruments, such as parametric insurance and catastrophe bonds or swaps;
- budget provisions for financing possible losses;
- post-disaster emergency budget reallocations; and
- post-disaster lines of credit or loans.

**Phase 1** (prior to the occurrence of the event): the government chooses the maximum amount to be financed with each instrument (Lj) which it will not be able to change once the actual amount of the losses is known.

**Phase 2** (subsequent to the occurrence of the event): once the amount of the losses is known, the government can choose what amount lj(x) it will finance through each instrument chosen in Phase 1, on the condition that the amount Lj fixed in the first phase cannot be exceeded. That is, lj(x) <=>j for all j and x.

The model must be actuarially "sound". That is, that the sum of what is obtained with each instrument is effectively equal to the amount intended to be financed –  $\Sigma$  lj(x) = x for all x.

A layered financing strategy is established where each layer is the amount financed through a specific instrument, in the understanding that the next layer will not be used until the previous layer has been exhausted.

Each of the instruments proposed is evaluated according to its financial particularities using the notion of opportunity cost of each (Cjx), understanding as such the economic cost involved in using that instrument j in the financing of the expenses x.

The outline of the model is presented on a table where each financial instrument is characterised in relation to two constants a and b –called cost parameters– which are mathematical proportions between their financial parameters (interest rate, premiums, etc.).

j	Instrument	aj	bj
1	Reserve Fund	i-r	1+r
		$\overline{1+i}$	$\overline{1+i}$
2	Line of Contingent Credit	i-c	1+c
		$\frac{\kappa + \rho}{1+i}$	1+i
3	Emergency Ex-post Budget Reallocation	0	1+h
			1+i
4	Ex-post Sovereign Borrowing	0	$(1+d_{t}a_{\overline{n}})$
			$(1+i) \overline{a_{\overline{n} e}}$
5	Insurance	0	m

TABLE 1: COST PARA	METERS OF DIFFERENT	RISK FINANCING INSTRUMENTS	

The conclusion, stated in the form of a theorem, is the following:

"If a government wishes to minimise the financing costs of disaster relief, it should use a layered loss financing strategy, where the xth unit of expenditure will be financed by the instrument j with the smallest relation  $a_j + b_j$  (1-F(z)) [where 1-F(z) is the likelihood of exceeding a given cost z and  $a_j$  and  $b_j$  are the cost parameters of the instrument j."

To set the ideas in a context, at the end of the study, the methodology is applied to a specific example, a hypothetical country with a set of given characteristics. The example shows that, obviously, the pre-existing economic situation and the type of risk to be addressed are key elements for determining the most cost-effective financing structure.

The conclusion of the study is that using a combination of different financial instruments is the most efficient manner from the opportunity-cost perspective for financing the amount earmarked for paying for the disaster relief.

In addition, there are other aspects, which are not of a quantitative nature and therefore do not arise as a conclusion of the study, but which do have an influence in favour of the use of risk transfer instruments, such as insurance. Insurance can solve the commitment problems faced by governments, enabling them to implement better-focussed responses quicker and without the need for the backing of powerful administrations from the financial point of view.

### References

Clarke, Daniel Jonathan; Wren-Lewis, Liam (2016) Solving commitment problems in disaster risk finance. Policy Research working paper; no. WPS 7720. Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/396511468197075071/Solving-commitment-problems-in-disaster-risk-finance

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